

Wood Burning Basics

If you did not grow up in a house with a wood burning stove in the parlor (or in the family room or great room if you are younger), you are probably wondering what is involved in burning wood for heat and enjoyment. Here are some of the most frequently asked questions about wood, about operating a catalytic stove, and about maintaining your wood burning stove:

Q: What is the best wood for a wood burning stove ?

A: On a pound-for-pound basis all wood contains just about the same amount of energy. However, on a volume basis there is a great difference in the heat given off by different woods. As a general rule, so-called "hardwoods" are more dense than "softwoods". They burn longer and give off more heat than softwoods. The following table should help you in choosing which woods to burn.

Species Having High Heat Value

(1 cord = 21,000,000 - 24,000,000 BTU = 200-250 gal. of fuel oil or 250-300 cu. ft. of natural gas)

American Beech	Red Oak
Apple	Sugar Maple
Hickory	White Oak
Ironwood	Yellow Birch

Species Having Medium Heat Value

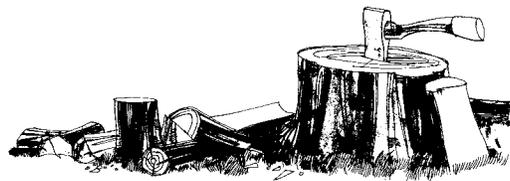
(1 cord = 17,000,000 - 20,000,000 BTU = 150-200 gal. of fuel oil or 200-250 cu. ft. of natural gas)

Big Leaf Maple	Red Maple
Eastern Larch	White Ash
Elm	White Birch

Species Having Low Heat Value;

(1 cord = 12,000,000-17,000,000 BTU = 100-150 gal. of fuel oil or 200-250 cu. ft. of natural gas)

Aspen	Red Alder
Cottonwood	Redwood
Hemlock	Sitka Spruce



Wise woodburners know the characteristics of the wood they burn. The right wood, properly seasoned, can increase heat output by as much as 50%

Q: Where do I get firewood?

A: For many people the most satisfying way is to cut your own. Even if you do not own a woodlot, you may find that someone who does would be happy to have you improve his woodland by culling out poor quality hardwoods. In many states you are allowed to cut in state forests. You can find out by contacting your county forester or your state's department in charge of parks and forests. As pointed out elsewhere in this presentation, even if you have to buy firewood, you can invariably save money over buying other kinds of fuel. You can usually find firewood vendors listed in the Yellow Pages or in the classified pages of your local newspaper. Look for someone who is honest about the types of wood he offers and how well seasoned it is. There is nothing wrong with buying green, unseasoned wood as long as the price reflects the fact that you cannot use it until you have taken the time to stack it and dry it. (More about that, below). It is important to understand the unit of measure most commonly used for wood: the cord.

Q: How much wood is in a cord?

A: Depending on the size of the pieces of wood and the care with which it is stacked, the actual amount of wood in a cord will vary considerably. It is legitimate for a cord to be as much as 1/3 air. However, no matter what length of firewood you buy, it must stack up to 8' x 4' x 4' to be a cord. Note: If you buy a cord of 4 foot lengths of wood and cut it up yourself, the resulting pile will take up less than a cord because of all the sawdust you create. A cord put into 16-inch or 24-inch lengths will shrink by 14 percent, or 18 cubic feet, in volume. Another measure by which wood is sold is the run. A run is 1/3 of a cord and measures 8 feet by 4 feet by 16 inches.

Q: So, what is a "face cord"?

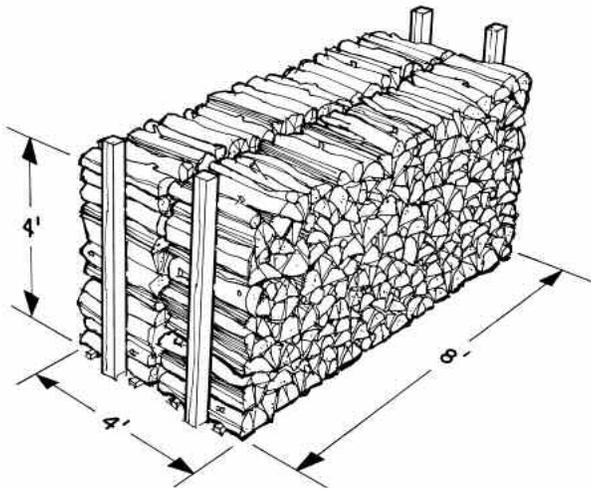
A: Wood is often advertised as so much per "face cord". But you should be very careful about buying wood on this basis. A "face cord" is a non-

When wood is first cut, up to 50% of its weight is water. It should be stored to dry under cover and in a well-ventilated place.



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A standard cord measures 128 cubic feet (or 4' x 4' x 8').

standard measurement that should never be confused with a cord. It measures 8 feet long by 4 feet high, but is only as deep as one length of wood. Obviously, it is possible for a face cord to contain considerably less than one cord of wood. Before buying a face cord of wood, you ought to use your calculator to figure how much you are paying on a cord basis; you may be unpleasantly surprised.

Q: Everyone says you should let your wood dry for a year before using it. Is it really necessary to burn seasoned wood?

A: The simple answer is yes. Seasoned wood will burn better, provide more heat, and cause fewer problems than green wood. When first cut, wood is often more than 50% water by weight. It takes a lot of energy to drive off this water -- which is what has to happen before the wood can burn. So green wood is hard to light, doesn't produce much heat, and smokes a lot. The water in green wood can also cool the catalytic combustor to the point that it will no longer function and/or cause smoke to condense on the inside of your chimney's walls as creosote. What is important is the dryness of the wood (optimally 15-25% water content), not the period of time it has been drying. At one extreme, some professional firewood suppliers use wood kilns to dry wood in only a few days. At the other extreme, unsplit, improperly stacked wood will rot long before it is ever dry enough to use.

Q: So, how do I tell if my wood is dry enough to use?

A: Partly, being able to tell if wood is dry is a matter of experience. However, some of the signs you can use to tell if your wood is dry are:

1) The wood is lighter than green wood. However, be aware that the density and weight of wood also depends on the species. White oak is denser and heavier than white pine. Still, dry white oak is lighter than wet white oak.

2) The bark is loose. As wood dries it tends to lose its

bark. This is not an absolute rule, but when your wood is dry you should notice a good bit of barkless wood and free pieces of bark.

3) The color of the wood fades. Different types of wood are more or less colorful, but for all species, dry wood is more subdued and faded looking than green wood.

4) The wood shows radial cracks. As wood dries it shrinks. As a result, it usually develops cracks, visible at the ends, which radiate out from the heartwood to the bark. Since the wood will often start to crack before it is completely dry, the presence of radial cracks is not a fool-proof sign that the wood is ready to burn. But, the total absence of such cracks is a good sign that it is not ready yet.



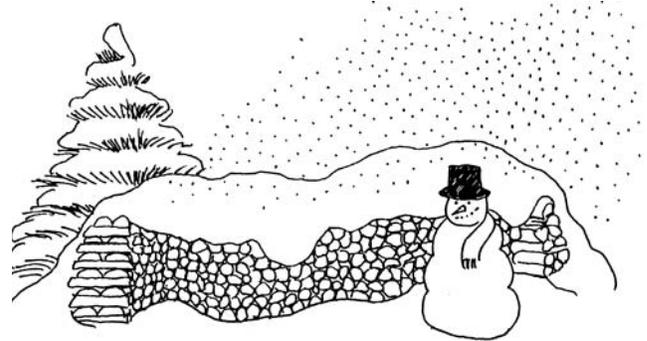
Don't cover your woodpile with a tarp or plastic sheet that goes all the way to the ground. Moisture will get trapped under the tarp, and the wood will not dry.

5) The wood loses its sappy smell. Dry wood is much less aromatic than green wood.

6) Dry wood makes a "crack" when hit. If you hit two pieces of seasoned wood together, they will make a resonant sound, like a bat hitting a baseball. Green wood makes more of a "thud".

Q: I have green wood, what do I do now?

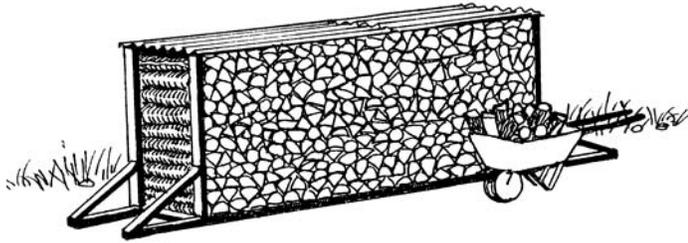
A: If you have the time, carefully stack your wood and let it dry. If you have no other options, try splitting the wood into smaller pieces, mixing dry wood or kindling with it, and letting more air into the stove, so it burns a little hotter.



Don't forget to cover your woodpile to protect it from rain and snow.

Q: What is the best way to dry my wood?

A: The best way to dry your wood is to split it and then stack it so that it is well-ventilated, covered and off the ground. Storing wood this way for 4-6 months can make a big difference in the efficiency of your stove. Split wood has much more surface area than unsplit wood. It also has surfaces that are not covered with bark. Therefore, it



Store your firewood off the ground on 2 x 4's or 2 x 6's. Cover it with plastic or metal roofing. Leave the sides open

will dry faster than unsplit wood. The ultimate example of this is birch wood. Because birch bark is waterproof (which is why Indians made canoes out of it), unsplit birch wood will often rot from the inside without ever drying. Wood not only takes up less space when stacked, but it allows air to circulate around the wood. Good ventilation is the most important factor in having dry wood. It helps to dry the wood by speeding up evaporation. If you have the space, you might want to employ a trick used by old timers. They stacked their wood in long thin rows spaced apart, and at right angles to the prevailing winds to ensure good ventilation. Covering the wood and keeping it off the ground are important because these practices keep the wood away from moisture. Wood acts very much like a sponge. If it is exposed to rain, snow or moisture in the ground, it will soak this water right up, putting to naught all your efforts to dry it out. With these basics in mind, there are a few simple rules you will want to follow:

- 1) Do cover the wood, but do not drape a plastic sheet or tarp over your wood pile so that it covers the sides of the pile. This will trap the moisture in the pile and the wood will not dry. If you can, make a simple wood frame to raise the plastic cover a few feet above the wood. The ultimate drying place is an open sided shed.
- 2) Use 2 x 4's, poles, or pallets or some other method to keep your wood off the ground.
- 3) If you dry your wood inside, allow for adequate ventilation. Wood stored in a heated space does dry faster. However, drying wood gives off a lot of water. If you do not allow for that water to exit to the outside you will probably raise a bumper-crop of mold and/or mushrooms. Another reason to be careful about storing wood inside is the fact that ants, beetles or other unwanted guests sometimes ride along on unseasoned wood.

Q: How do I go about lighting the wood burning stove?

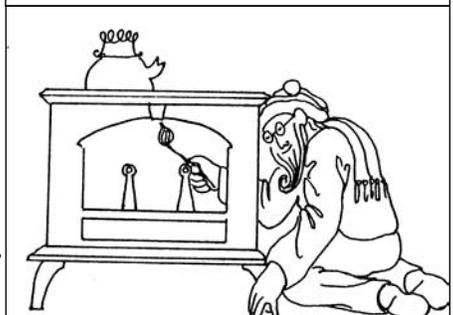
A: For your wood burning stove to work you must have a good draft from your chimney. It is, therefore, important to check the draft before you light your wood stove. If the draft is static, or if you have a downdraft, you will need to correct this situation before you light the wood burning stove. Otherwise, you might get some smoke back in the house. To check the draft, open the side door and catalytic bypass damper on the wood stove. Light a match in front of the flue outlet of your wood burning stove. If the flame is pulled into the flue outlet, you have adequate draft to light your stove. If the flame doesn't move, or if it comes back toward you, you do not have enough draft to light the stove, and you need to correct this situation before kindling a fire. To establish proper draft before lighting the wood burning stove with the loading door and catalytic bypass open:

- 1) Open a door or window in the room in which the stove is installed;
- 2) Wait a minute or two, and then try lighting a match in the flue outlet again.
- 3) If the chimney draws, then light a small sheet of newspaper in the flue outlet. This will get some heat in the chimney and help to establish a good draft. Opening a door or window for a few minutes in the room where the wood burning stove is installed should reverse house

Before lighting a fire in a Fireview, lift the top lid and check the draft by holding a match is the flue outlet of the stove. If the flame is pulled into the flue outlet, it is OK to light the stove. If there is no draft, open a door or window in the room where the stove is installed, wait a few minutes, and try again.

Sometimes it is necessary to get some heat in the chimney to establish draft. If the match test is unsuccessful, light a small wad of newspaper and put it in the flue collar with the stove damper open and a door or window open. Often a small amount of heat in the first section of pipe will establish draft.

The procedure is the same for the Palladian or Keystone (below), but you will have to reach inside the stove to hold a match in the flue



pressure and allow the chimney to begin to draw. This should be evident the second time you light a match in the flue outlet -- the flame should be pulled into the flue opening. As an added measure you can warm the chimney and encourage more draft by crumpling up a piece of newspaper into the shape of a torch, lighting it and holding it at the flue outlet. If these measures have not been sufficient to provide a good draft, you should review the information on wood burning stove installation and proper ventilation located elsewhere on our web page. Having established that you have an adequate draft, proceed to build your fire. Start with several sheets of newspaper loosely crumpled. Make a mound of these in the firebox. Around and on top of the paper, place, tentlike, small scraps of dry wood. Dry softwoods like pine or spruce are ideal whether they are construction scraps or dead branches from trees in your yard. Touch a match to the paper. Once the kindling wood has started to burn, add three or four small pieces of firewood. Once they are burning briskly, you can gradually build up the fire to the desired size. After about 20 minutes, your fire should be burning hot and with only a little smoke. Check the thermometer that comes with your stove and see if the temperature indicates that it is OK to close the bypass damper to engage the catalytic combustor.

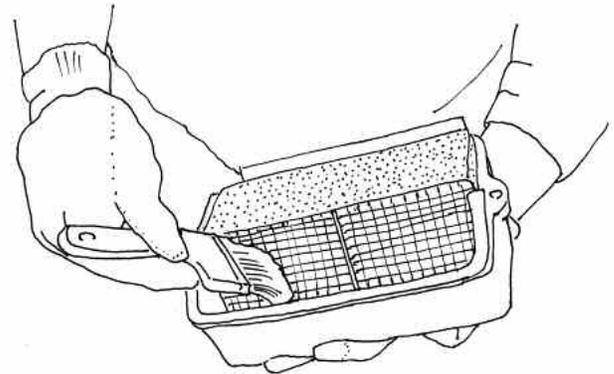
Q: Just what is a catalytic combustor?

A: The catalytic combustor in your wood burning stove is a ceramic honeycomb device placed between the fire and the stove pipe. The smoke from the fire passes through the combustor before exiting the stove. The surface of the combustor is coated with a thin layer of platinum or palladium. This metal "burns" the wood smoke, reducing the stove's emissions and helping to heat your house. To understand how this happens, it is necessary to know something about fires and what happens when wood burns. Fire is a chemical reaction. For a fire you need three things: fuel, oxygen and heat. The fuel and oxygen must be present in the right proportion and the temperature must be high enough. If these conditions are not met the fire will not burn properly. When a log is placed in the fire it undergoes a three stage process: First, all the water in the wood is driven off as steam. (Doing this absorbs heat, lowering the fire's temperature and reducing the amount of energy available to heat your house. That is why it is so important to use dry, seasoned wood in your stove. Even dry wood will contain some moisture, but a minimal amount that will evaporate quickly.) Second, the wood undergoes a process called "pyrolysis", releasing gases which are burned or which escape as smoke. (The burning of these gases causes the beautiful flames you see in your stove.) Third, the carbon in the wood burns as "coals". High temperatures (in excess of 1100-1200 degrees Fahrenheit) are needed for the gases to burn. Unfortunately, most wood burning stoves cannot consistently produce temperatures in this range and many of the gases never get hot enough to burn. The result is

woodsmoke that contains carbon monoxide, soot, free hydrogen, tars, and other organic compounds. The catalytic combustor causes the gases to burn at much lower temperatures (around 500 degrees Fahrenheit) than they would otherwise. The result is that your wood burning stove emits only steam (carbon dioxide and water), and your chimney stays much cleaner. Your stove also becomes much more efficient because you are making use of the energy in the woodsmoke. As noted above, using a catalytic combustor can increase the stove's efficiency by up to 25%.

Q: How do I operate the catalytic combustor?

A: Operation of the catalytic combustor is relatively simple. After about 20 minutes, the wood burning stove should reach operating temperatures as indicated by the thermometer supplied with the stove. Once it has done so, simply close the catalytic bypass damper so that smoke passes through the catalyst. The combustor will ignite and begin to function, burning the smoke and cleaning up the stove's emissions. At this point, follow the Goldilocks rule. Like Goldilocks with the three bear's porridge, the combustor is happiest when it is neither too hot nor too cold. The combustor needs to remain hot enough to function and not so hot that it is damaged. Use of the stove thermometer will help you to operate the stove in the correct temperature range.



Fly ash should be removed from the catalytic combustor cells periodically with a vacuum cleaner or a soft brush.

Q: What maintenance does the combustor need?

A: You should inspect the "upstream side" of your catalytic combustor periodically, and remove any fly ash that has accumulated on it. (The "upstream side" of the combustor is the side closest to the fire, and the side that the smoke enters.) We recommend that you inspect and/or clean the upstream side of the catalytic combustor after every 60 days of use (more often if you suspect that the wood you are using is not dry). The upstream side can become partially obstructed with air-borne fly ash. If this happens, the catalyst's performance will be impaired and the draft will be reduced. See the instructions which came with your

stove for how to clean the combustor in your particular model. If you are using your stove as a primary source of heat, and burning it all day, every day throughout the cold winter months, then your combustor should be replaced every 4-5 years. A new combustor will give you more heat for the wood that you burn; it will help you to conserve wood, and your wood burning stove will burn more cleanly.

Q: How do I tell if my combustor needs replacing?

A: There are three basic ways to tell if your catalytic combustor is not working:

- 1) The smoke coming out of your chimney will be noticeably darker;
- 2) The wood burning stove will not generate temperatures as high as it once did; and
- 3) You may get a build-up of creosote or soot in the chimney.

Q: What about cleaning the wood burning stove?

A: You will, of course, need to remove ashes from your stove. The most important thing about ash removal is that ashes be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil, or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. Live



Woodstove ashes should always be stored in a metal container with a tight-fitting lid, and disposed of away from the house. NEVER put the ash bucket on a wood porch or deck, for example.

cinders can take up to 36 hours to cool. Never leave the ash container on a wood porch or deck or on wooden steps. Never shovel ashes into a combustible container like a cardboard box or a plastic pail. Do not use a vacuum cleaner to remove ashes. For specific directions on how to remove the ashes from your model stove, follow the instructions that came with it.

Q: How do I clean the window in my wood burning stove?

A: The window in the stove is designed to remain clean during use. However, the window may soot up the first time you use the stove. Don't be alarmed. As soon as the stove temperature is high enough, the glass will clean itself (i.e. the deposits will burn off) and it will stay clean. Accumulations of this sort can also happen in the spring and fall when temperatures are mild and wood is likely to be damp. To clean the inside of the glass, use finest (#0000) steel wool. The glass is actually cast ceramic so the fine steel wool won't etch or scratch it. (Warning: Be sure the fire is out and the glass is cool before attempting to clean it.) If you use a chemical cleaner, be sure that the inside of the glass is dry before you start the next fire, so that smoke or soot does not get trapped in moisture on the glass.

Q: What other maintenance needs to be done?

A: If the soapstone surface of the stove becomes scratched or blemished you can use extra fine (#000) steel wool to touch it up. Using the steel wool, rub the soapstone with circular motion. This is the same type of steel wool used by furniture makers to polish fine furniture and it will not mar the surface of the soapstone. If you need to remove deep scratches or gouges, use a more abrasive material like 120 grit sandpaper or a coarser grade of steel wool. After the scratch or gouge has been removed, polish the area you worked on with extra fine (#000) steel wool to restore its original finish. If you need to refinish the cast iron parts with touch-up paint, mask off the soapstone in the area that you wish to paint by sliding pieces of paper under the edges of the castings. (You will be able to push the paper under the soft fiberglass rope gasket which is used to seal the seams.) Then, carefully touch-up the exposed casting with high temperature stove paint.